

1        SYSTEM AND METHOD FOR CALL CENTER DIALOG MANAGEMENT

2  
3                    BACKGROUND OF THE INVENTION

4        1.        Field of the Invention

5                The present invention relates generally to systems and methods for call  
6 management, and more particularly to varying a call center dialog property.

7        2.        Discussion of Background Art

8                Call centers are increasingly used to manage calls to and from a variety of  
9 entities and in a variety of applications. Some entities (i.e. contacts) include, existing  
10 customers, potential customers, suppliers, and vendors. Some call center applications  
11 include, providing movie theatre listings and driving directions, automated banking,  
12 and product marketing.

13               Such systems often use Interactive Voice Response (IVR) software as a first  
14 step in processing an incoming call before connecting the contact with a human  
15 operator. The IVR software tends to improve the call center's efficiency and reduce a  
16 number of human operators required to handle the contacts.

17               In a typical dialog between the IVR software and the contact, the IVR software  
18 presents the contact with either information or a question. The contact listens to the  
19 information or question, and then responds in some way, either by requesting more  
20 information or answering the question. The IVR system's portion of the dialog  
21 typically consists of either prerecorded messages or synthesized text generated by a  
22 Text-To-Speech (TTS) algorithm.

23               However, while the actual information presented to the contact can greatly  
24 vary depending upon the outcome of such questions and answers, how that  
25 information is presented to the contact tends to have a fixed set of properties which  
26 are set when the IVR system's software is first compiled. Such rigid properties often

1 present the IVR system's dialog in a wooden, awkward, inefficient, and hard to  
 2 understand way, so much so that contacts often become confused and or frustrated  
 3 with the dialog, resulting in either a lost sale, or premature connection to a human  
 4 operator.

5         So while an IVR system designer might be able to modify how the IVR system  
 6 presents the dialog before an IVR system's source code is compiled, present call  
 7 center IVR systems do not give contacts control in how the IVR system's dialogs are  
 8 presented during execution the IVR system's object code.

9         In response to the concerns discussed above, what is needed is a system and  
 10 method for call management that overcomes the problems of the prior art.

11

SUMMARY OF THE INVENTION

The present invention is a system and method for call center dialog management. The method of the present invention includes: presenting a contact with a first call center dialog segment having a current call center dialog property; receiving from the contact a contact dialog segment; identifying a dialog property keyword within the contact dialog segment; replacing the current call center dialog property with a new call center dialog property in response to the dialog property keyword; and presenting a second call center dialog segment having the new call center dialog property to the contact. The system of the present invention, includes all means for implementing the method.

These and other aspects of the invention will be recognized by those skilled in the art upon review of the detailed description, drawings, and claims set forth below.

1                                    BRIEF DESCRIPTION OF THE DRAWINGS

2                    Figure 1 is a dataflow diagram of one embodiment of a system for call center  
3 dialog management;

4                    Figure 2 is a flowchart of one embodiment of a root method for call center  
5 dialog management; and

6                    Figure 3 is a flowchart of one expanded embodiment of the root method for  
7 call center dialog management.

8

1           DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

2           The present invention enables the properties of a dialog between a contact and  
3   a call center to be varied in real-time as the call center and contact interact. For  
4   example, a dialog's speed property can be adjusted based on the call center's analysis  
5   of how the dialog is proceeding, or manually adjusted by a party in contact with the  
6   call center, based on that contact's needs and preferences. Such flexibility greatly  
7   improves a call center's responsiveness to contacts. For instance, contacts more  
8   accustomed toward listening slowly, or contacts not fluent in the language of the  
9   dialog can reduce the dialog's speed, while those contacts able to listen more quickly  
10   and who are perhaps more familiar with the dialog's subject matter can increase the  
11   dialog's speed.

12  
13          Figure 1 is a dataflow diagram of one embodiment of a system 100 for call  
14   center dialog management. A call center 102 enters into a dialog with a contact 104.  
15   The dialog may have been initiated by the contact 104 who called the call center 102  
16   (i.e. an incoming call), or by the call center 102 which called the contact 104 (i.e. an  
17   outgoing call). Typical call centers include both computer systems and human  
18   operators which interact with various contacts. Contacts are most often human, but in  
19   some instances can include other non-human entities, such as a computer system.

20          The call center 102 presents a first call center dialog segment having a current  
21   set of call center dialog properties to the contact 104. The call center 102 then  
22   receives a contact dialog segment generated by the contact 104.

23          The subject matter of the call center's 102 dialog segments is dependent upon  
24   information stored in both a dialog database 106 and a contact database 108. The  
25   dialog database 106 contains dialog segments (i.e. messages and prompts) having  
26   varying levels of specificity. Some of the dialog database's 106 messages may be

1 very generic, such as “Hello, you’ve reached ...”, and are intended to be presented to  
2 many if not most contacts. Other messages in the dialog database 106 may be very  
3 specifically tailored toward a particular type of information being exchanged between  
4 the call center 102 and the contact 104, such as “Your portfolio currently includes ...”.

5         The contact database 106 associates each contact with a specific set of contact  
6 attributes. Such attributes include: the contact’s phone number and address, a  
7 relationship status (such as whether the contact is a customer and etc.), a historical  
8 record of the contact’s 104 past and present dialogs with the call center 102, a set of  
9 speech segments (i.e. recorded vocal utterances) and translated text 110, and many  
10 other attributes known to those skilled in the art. These attributes may be populated  
11 and supplemented from a variety of sources, including the call center’s 102 own  
12 dialog questions, publicly available phone directories, the internet, and customer  
13 warranty cards.

14         The subject matter of the dialog depends upon the call center’s 102 purpose  
15 and the contact’s 104 attributes. Thus, if the call center’s purpose was to provide  
16 contacts with financial information, then the contact 104 will be presented with a  
17 dialog that first asks a series of generic security verification questions followed by a  
18 more specific set of portfolio questions and prompts retrieved from the dialog  
19 database 106. The contact 104 would then be presented with the contact’s 104 own  
20 portfolio information retrieved from the contact database 108.

21  
22         A call manager 112 within the call center 102 activates an Interactive Voice  
23 Response (IVR) module 114. The IVR module 114 translates the contact’s 104 vocal  
24 utterances and telephone tones into a form which the call center can understand using  
25 either Natural Language Processing (NLP ) algorithms, Automated Speech  
26 Recognition (ASR) algorithms, or Voice Extensible Markup Language (Voice-XML)

1 interpreters. The IVR module 114 also translates the call center's dialog segments, in  
2 accordance with the current call center dialog properties, into an audible form which  
3 the contact 104 can understand. The IVR module 114 draws upon either pre-recorded  
4 dialog segments 116 stored in the dialog database 106, a Text-To-Speech (TTS)  
5 module 118, or a digital signal processor module 120 in order to help present the call  
6 center's dialog to the contact 104. The call manager 112 stores a historical record of  
7 both the call center 102 and contact 104 dialog segments in the contact database 108.

8  
9 Operating in parallel with the dialog between the contact 104 and the call  
10 center 102 is a dialog analysis module 122. The dialog analysis module 122 identifies  
11 a set of dialog property keywords from the various contact dialog segments within the  
12 dialog.

13 Dialog property keywords related to the dialog's speed include, "faster" and  
14 "slower". For example the contact 104 could say either "Speak faster", "Could you  
15 please speak faster", "Faster please", "Slow down", "Could you please speak slowly",  
16 or "Slower please" in order to request that the speed of the call center's 102 portion of  
17 the dialog be either increased or decreased respectively. Thus each contact with the  
18 call center 102 can individually control the speed of their own dialog with the call  
19 center 102. Such explicit requests by the contact 104 for adjusting the speed of the  
20 dialog are preferably understood by the call center 102 using the Voice-XML  
21 interpreter within the IVR module 114. So that the contact 104 does not accidentally  
22 invoke one of the keywords during the dialog, the actual keywords searched for by the  
23 dialog analysis module 122 are selected to minimize any direct or phonetically  
24 equivalent conflict between the keywords and the contact's 104 normal dialog with  
25 the call center 102. For example, if the contact's 104 normal dialog with the call

1 center 102 is expected to include the word “faster”, then “faster” would not be  
2 selected as a keyword.

3 The dialog analysis module 122 replaces the current call center dialog  
4 properties with a new set of call center dialog properties, in response to the identified  
5 dialog property keywords. For instance, in the example above where the dialog  
6 property keywords relate to a speed at which the call center’s 102 dialog segments are  
7 presented to the contact 104, the first call center dialog property differs from the  
8 second call center dialog property by the speed with which the call center’s 102 dialog  
9 segments are to be presented to the contact 104. The speed may either be increased or  
10 decreased as directed by the keyword.

11

12 In parallel with the functionality above, the dialog analysis module 122 also  
13 executes an automated dialog property management routine which can modify the call  
14 center’s dialog properties as well, as is now discussed. The dialog analysis module  
15 122 retrieves the contact’s 104 attributes, speech segments, and translated text from  
16 the contact database 108. The data retrieved includes the current dialog between the  
17 contact 104 and the call center 102. The dialog analysis module 122 generates a set of  
18 dialog metrics, representative of the current dialog between the contact 104 and the  
19 call center 102, from the information retrieved.

20 The set of dialog metrics include: a contact dialog interpretation error rate,  
21 indicative of how many times the contact 104 was asked to repeat the contact’s 104  
22 answer to a call center 102 question; a grammar error rate, indicative of how poor the  
23 contact’s 104 grammar is; and a contact help request rate, indicative of how often the  
24 contact 102 requests access to the call center’s 102 help directory. These metrics are  
25 specific instances of a general dialog quality metric. Those skilled in the art will  
26 recognize that other heuristics and metrics for determining how “well” the dialog



1 between the contact 104 and the call center 102 is proceeding and how “well” the  
2 contact 104 is “handling” the dialog.

3 The dialog analysis module 122 compares the set of dialog metrics against a  
4 first set of dialog metric thresholds. If the generated dialog metrics varies from the  
5 first set of thresholds by a predetermined amount, the dialog analysis module 122  
6 replaces the current call center dialog properties with a new set of call center dialog  
7 properties. Automatic modification of the call center’s dialog properties is intended to  
8 bring the dialog metrics back within a permitted variation from the first set of  
9 thresholds.

10 For example, if the contact dialog interpretation and grammar error rates  
11 exceed a first set of error rate thresholds, indicating that the contact 104 is having  
12 difficulty with the dialog, the dialog analysis module 122 can replace the call center’s  
13 current dialog speed with a new slower dialog speed. However, if the contact dialog  
14 interpretation and grammar error rates fall below the first set of thresholds, indicating  
15 that the contact 104 is actually doing quite well with the dialog, then the dialog  
16 analysis module 122 can replace the call center’s current dialog speed with a new  
17 faster dialog speed, enabling the contact 104 to more quickly dialog with the call  
18 center 102.

19 Since the dialog analysis module 122 contains two routines for modifying the  
20 call center’s 102 dialog properties (e.g. the dialog property keyword routine and the  
21 automated dialog property management routine), the dialog analysis module 122  
22 preferably uses the automated dialog property management routine only if the contact  
23 104 has not invoked any of the keywords.

24

25 The dialog analysis module 122 transmits the new call center dialog properties  
26 to a dialog property controller 124. The dialog property controller 124 replaces the

1 current set of call center dialog properties with the new set of dialog properties, using  
2 one of several different techniques, three of which are now described.

3       The first technique relies on the pre-recorded dialog segments 116 stored in  
4 the dialog database 106. The pre-recorded dialog segments 116 include a set of  
5 digitized pre-recorded call center dialog segments. These segments are pre-recorded  
6 by a person speaking the dialog segment, and then stored in the dialog database 106.  
7 While various sub-sets of the dialog segments 116 contain the same substantive  
8 information, they are recorded in a different form (i.e. with different dialog  
9 properties). For instance, the dialog segment “Hello ...” can be recorded in several  
10 different languages, while still substantively being “a greeting”. Similarly, the dialog  
11 segment “Hello ...” can be recorded at different speeds, one at a slow pace, one at a  
12 moderate pace, and one at a fast pace. Thus, the dialog property controller 124  
13 replaces a first pre-recorded call center dialog segment having the current set of  
14 properties with a second pre-recorded dialog segment having the new set of  
15 properties.

16       The second technique varies parameters within the text-to-speech module 118.  
17 The text-to-speech module 118 translates written text within the dialog database 106  
18 into audible sounds corresponding to the text which the contact 104 can understand.  
19 The text-to-speech module 118 includes a synthesizer whose synthesized speech  
20 parameters, such as pitch, duration, rate, etc., can be automatically varied. For  
21 example, the speed of the dialog can be varied by adjusting the text-to-speech  
22 module’s 118 rate parameter. Dialog speed can be varied in a Voice-XML  
23 implementation of this technique, by controlling a <prosody> tag inside the <dialog>  
24 tag. The <prosody> tag controls a rate by which a dialog is played. When the  
25 dialog’s properties can be varied using the text-to-speech module 118, the dialog  
26 property controller 124 can more finely tune the properties than by varying the pre-

1 recorded dialog segments of the first technique. Then the dialog property controller  
2 124 adjusts a text-to-speech synthesizer so that subsequent call center dialog segments  
3 are generated using the new set of properties instead of the current set of call center  
4 dialog properties.

5 The third technique uses the digital signal processing module 120 to adjust  
6 some of the dialog's properties. For example, dialog speed is varied by using the  
7 digital signal processing module 120 to perform signal processing time-scale  
8 modifications which can either speed-up or slow-down the dialog's speed. Several  
9 digital signal processing filters are well known for this purpose. Then the dialog  
10 property controller 124 adjusts a digital signal processor parameter so that subsequent  
11 call center dialog segments are generated using the new set of properties instead of the  
12 current set of call center dialog properties. Those skilled in the art will recognize that  
13 other techniques for varying dialog properties are also possible.

14  
15 The IVR module 114 presents subsequent call center dialog segments to the  
16 contact 104 using the new call center dialog properties. Thus modifications to the call  
17 center dialog properties are effected in a seamless way, while the dialog between the  
18 contact 104 and the call center 102 occurs, and there is no need to either halt or  
19 interrupt execution of the dialog or the call center's 102 software.

20  
21 Figure 2 is a flowchart of one embodiment of a root method 200 for call center  
22 dialog management. In step 202 of the root method 200 the contact 104 is presented  
23 with a first call center dialog segment having a current call center dialog property. In  
24 step 204, a contact dialog segment is received from the contact. In step 206,  
25 determining from the contact dialog segment whether the current call center dialog  
26 property should be changed. In step 208, the current call center dialog property is

1 replaced with a new call center dialog property in response to the determining step.  
2 Then in step 210, a second call center dialog segment having the new call center  
3 dialog property is presented to the contact. The root method 200 is discussed in  
4 further detail with respect to Figure 3.

5  
6 Figure 3 is a flowchart of one expanded embodiment of the root method 300  
7 for call center dialog management. In step 301, a call center 102 enters into a dialog  
8 with a contact 104. The dialog may have been initiated by the contact 104 who called  
9 the call center 102 (i.e. an incoming call), or by the call center 102 which called the  
10 contact 104 (i.e. an outgoing call).

11 In step 302, the call center 102 presents a first call center dialog segment  
12 having a current set of call center dialog properties to the contact 104. In step 303, the  
13 call center 102 receives a contact dialog segment generated by the contact 104.

14 In step 304, a call manager 112 within the call center 102 activates an  
15 Interactive Voice Response (IVR) module 114. In step 306, the call manager 112  
16 stores a historical record of both the call center 102 and contact 104 dialog segments  
17 in the contact database 108.

18 Operating in parallel with the dialog between the contact 104 and the call  
19 center 102 is a dialog analysis module 122. In step 308, the dialog analysis module  
20 122 identifies a set of dialog property keywords from the various contact dialog  
21 segments within the dialog.

22 In step 310, the dialog analysis module 122 replaces the current call center  
23 dialog properties with a new set of call center dialog properties, in response to  
24 identified the dialog property keywords. For instance, in the example above where the  
25 dialog property keywords relate to a speed at which the call center's 102 dialog  
26 segments are presented to the contact 104, the first call center dialog property differs

1 from the second call center dialog property by the speed with which the call center's  
2 102 dialog segments are to be presented to the contact 104. The speed may either be  
3 increased or decreased as directed by the keyword.

4  
5 In parallel with steps 308 and 310 above, the dialog analysis module 122 also  
6 executes an automated dialog property management routine which can modify the call  
7 center's dialog properties as well, as is now discussed. In step 312, the dialog analysis  
8 module 122 retrieves the contact's 104 attributes, speech segments, and translated text  
9 from the contact database 108. In step 314, the dialog analysis module 122 generates  
10 a set of dialog metrics, representative of the current dialog between the contact 104  
11 and the call center 102, from the information retrieved in step 312.

12 In step 316, the dialog analysis module 122 compares the set of dialog metrics  
13 against a first set of dialog metric thresholds.

14 In step 318, if the generated dialog metrics varies from the first set of  
15 thresholds by a predetermined amount and no keywords have been identified, the  
16 dialog analysis module 122 replaces the current call center dialog properties with a  
17 new set of call center dialog properties.

18  
19 In step 324, the dialog analysis module 122 transmits the new call center  
20 dialog properties to a dialog property controller 124. In step 326, the dialog property  
21 controller 124 replaces the current set of call center dialog properties with the new set  
22 of dialog properties, using one of several different techniques, three of which are now  
23 described. Using the first technique, in step 328, the dialog property controller 124  
24 replaces a first pre-recorded call center dialog segment having the current set of  
25 properties with a second pre-recorded dialog segment having the new set of  
26 properties. Using the second technique, in step 330, the dialog property controller 124

1 adjusts a text-to-speech synthesizer so that subsequent call center dialog segments are  
2 generated using the new set of properties instead of the current set of call center dialog  
3 properties. Using the third technique, in step 332, the dialog property controller 124  
4 adjusts a digital signal processor parameter so that subsequent call center dialog  
5 segments are generated using the new set of properties instead of the current set of call  
6 center dialog properties. Those skilled in the art will recognize that other techniques  
7 for varying dialog properties are also possible.

8  
9 Then in step 334, the IVR module 114 presents subsequent call center dialog  
10 segments to the contact 104 using the new call center dialog properties.

11  
12 Note, while the present invention has been discussed primarily with respect to  
13 a dialog speed property, those skilled in the art will recognize that other dialog  
14 properties, such as dialog language choice, how concise the call center's dialog  
15 segments are (i.e. a contact expertise level where there can be novice, intermediate,  
16 and expert level segments, whereby the expert level segments are presented to  
17 knowledgeable contacts, while the novice level segments are presented to less skilled  
18 contacts), how detailed the help messages presented to the contact are (i.e. a contact  
19 help level), and many other properties can be dynamically varied as the system 100  
20 executes as well.

21  
22 While one or more embodiments of the present invention have been described,  
23 those skilled in the art will recognize that various modifications may be made.  
24 Variations upon and modifications to these embodiments are provided by the present  
25 invention, which is limited only by the following claims.